CRITICAL PRESSURE CALCULATION
CTV III

Critical Pressure Calculation

The Critical pressure was calculated using the methods of Nicol et al. (2008), which is referenced in the US EPA AoR and Corrective Action Guidance.

[redacted]

Figure 1. [redacted] Pressure profile and data

For the purpose of calculating the critical pressure and delineating the AoR for the project area, [redacted], and the following equations were used to calculate critical pressure across the model domain :

$$\Delta P_{C,norm} = g(Z_V - Z_I)[\frac{\lambda-\xi}{2}(Z_V - Z_I) + \rho_{I,\lambda} - \rho_I] \quad \text{- Eq (1)}$$

$$\Delta P_c = \Delta P_{C,norm} + \Delta P_u \quad \text{- Eq (2)}$$

Where,

- $\Delta P_{C,norm}$ - the admissible overpressure in a normally pressured aquifer before fluid in the injection zone would flow into the USDW through a hypothetical open conduit
- ΔP_c - the admissible overpressure in an under-pressured aquifer before fluid in the injection zone would flow into the USDW through a hypothetical open conduit
- ΔP_u - the difference of normal pressure to actual pressure in the under-pressured aquifer, assumed [redacted] psi across the model domain
- g - acceleration due to gravity, 9.81m/s^2
- Z_V - Elevation of the injection zone
- Z_I - Elevation of the base of the USDW
- λ - density gradient in the conduit at constant injection zone brine TDS

ξ - density gradient in the conduit at initial condition
$\rho_{I,\lambda}$ - Density of the injection zone brine at USDW depth
ρ_I - Density of the brine in the conduit at USDW depth at initial condition

An average TDS of 15,500ppm was assumed for the injection zone and an average TDS of 7,900ppm was assumed for the USDW based on Salinity calculations in the project area. Injection zone and USDW depths were based on the model grid and USDW mapping in the project area. Density and density gradients were calculated as a function of temperature and salinity using standard methods (McCutcheon et. al. 1993). Using these, the critical pressure was calculated at each grid point in the Petrel model using Equations 1 & 2 and combined with the pressure outputs from the plume simulation to delineate an AoR boundary at different timesteps. The final AoR boundary was based on the outermost threshold overpressure 14 years into injection which is when the maximum extent was seen. 50 years after the end of injection, the pressure buildup in the reservoir dissipates to approximately zero.

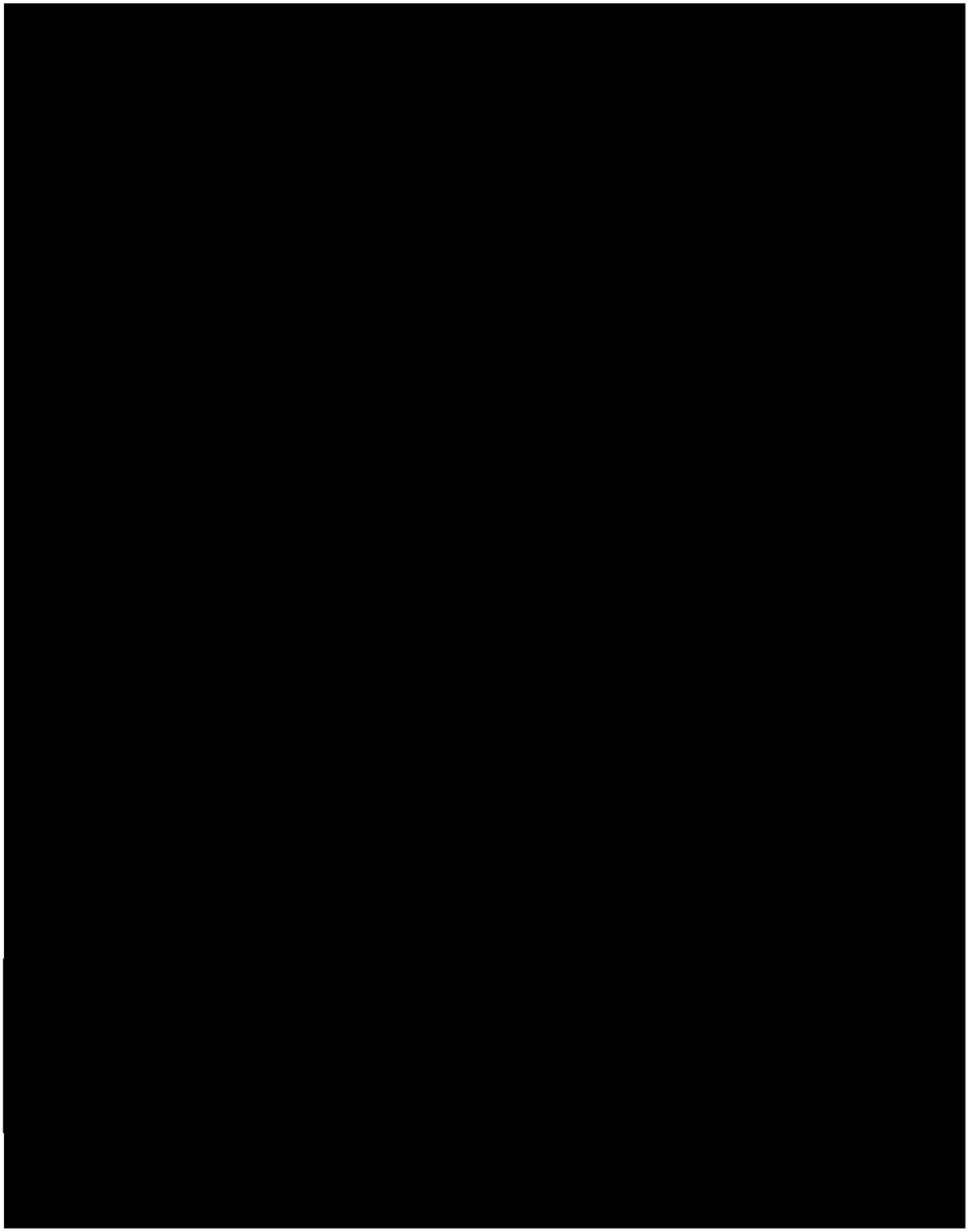

Figure 3. Map showing location of wells with pressure data [redacted]

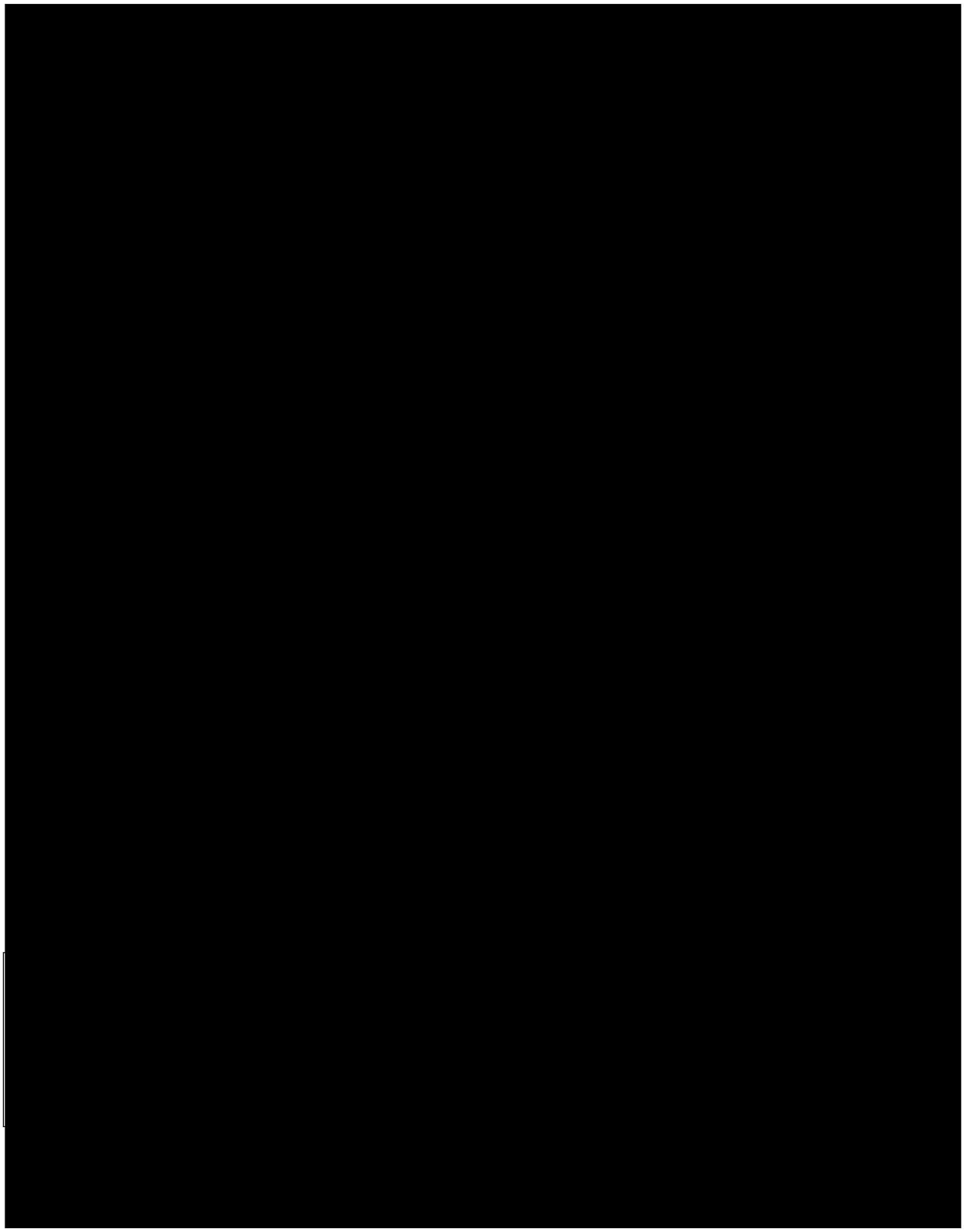

Figure 5: Map showing the location of injection wells and plume monitoring wells.